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Blood Lead Levels in Young Children ---United States and Selected States, 1996--1999

Lead exposure adversely affects the cognitive development and behavior of young children (1). For children aged <6 years, CDC has defined an elevated blood lead level (BLL) as >10 µg/dL, but evidence exists for subtle effects at lower levels (2). Data from CDC's Third National Health and Nutrition Examination Survey, Phase 2 (1991--1994) (NHANES) showed that average BLLs in children had decreased approximately 80% since the late 1970s but that elevated BLLs remained more common among low-income children, urban children, and those living in older housing (3,4). Although these data provide national estimates of the prevalence of elevated BLLs among children, they do not provide information at the state or local level. To target prevention efforts and monitor progress toward reducing BLLs at the state and local level, CDC's Childhood Blood Lead Surveillance (CBLS) program supports state blood lead surveillance programs on the basis of blood lead tests from public and private clinical laboratories. This report summarizes data on BLLs in children aged 1--5 years from NHANES data collected in 1999 and children aged <6 years from state surveillance data provided to CDC by 19 state surveillance programs during 1996--1998. The findings indicate that, despite the decreases in mean BLL among children, the problem remains concentrated on a local level. Surveillance efforts should be used to target screening efforts to communities at highest risk.

NHANES is a continuous survey of the health and nutritional status of the U.S. civilian, noninstitutionalized population designed so that each year of data constitutes a nationally representative sample. Data in this report are from NHANES 1999, and NHANES III, Phase 2. A household interview and a physical examination were conducted for each survey participant. During the physical examination, blood was collected by venipuncture for all persons aged >1 year. Graphite furnace atomic absorption spectrophotometry was used to measure BLLs with detection limits of 0.3 µg/dL (NHANES 1999) and 1.0 µg/dL (NHANES III, Phase 2). Long-term quality-control data for these analyses, including similar standardized reference materials, were used in both surveys and showed that data from the two surveys can be compared. Because of limited sample size, NHANES 1999 analyses include only data on average BLLs and selected percentiles but not on the prevalence of elevated levels.

The analyses of CBLS data were based on reports from 19 of 28 states that provided blood lead data to CDC (Table 1). The 19 states were included because they received all blood lead test results of children from participating laboratories (regardless of level) and reported

data
from January 1, 1996 through December 31, 1998. These states accounted for 33% of all U.S. children aged <6 years.

An elevated BLL from CBLS is defined as a single blood lead test result
>10 µg/dL. If multiple tests were reported for a child during a calendar year, the highest BLL measured for that child was used. To estimate the proportion of children with elevated BLLs among those tested, the number of children with elevated levels was divided by the number of children tested at least once during a calendar year.

From NHANES III, Phase 2 (1991--1994) to NHANES 1999, the geometric mean
BLL in children aged 1--5 years decreased from 2.7 (95% confidence interval [CI]=2.6--2.9) to 2.0 µg/dL (95% CI=1.7--2.3), and the 50th percentile decreased from 2.6 (95% CI=2.4--2.8) to 1.9 µg/dL (95% CI=1.6--2.1). The continued pattern of decline in BLLs between the two surveys also is indicated at the 10th, 25th, 75th, and 90th percentiles.

The CBLS data showed that the proportion of children tested with BLLs >10 µg/dL decreased from 10.5% in 1996 to 7.6% in 1998 in the 19 states providing data (Table 1). The proportions of children with BLLs >15 µg/dL and >20 µg/dL also decreased.

The percentage of children aged <6 years tested with BLLs >10 µg/dL in each state ranged from 2.7 to 14.9 (Figure 1). Within states, the proportion of children with elevated BLLs in counties with at least 200
children tested also varied considerably. For example, the proportion of
children with elevated BLLs ranged from 1.3% to 27.3% in counties in Ohio. Across all 19 states, the county-specific proportions of children
with elevated BLLs ranged from 0.5% to 27.3%, indicating a concentrated
proportion of elevated BLLs in specific populations or geographic areas.

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Editorial Note:

The findings in this report indicate that average BLLs of U.S. children
aged 1--5 years have declined from the early 1990s to 1999. Because of the limited sample size of a single year of NHANES 1999 compared with that of the multiple years of NHANES III, additional data are necessary
to confirm this trend. The dramatic decline in BLLs from the late 1970s
through the early 1990s resulted primarily from the phase-out of leaded
gasoline and the resulting decrease in lead emissions, although other exposures also decreased (3). Although air lead levels and lead emissions continued to decrease during the 1990s, most of this decline occurred before 1995 (5). The primary remaining sources of childhood lead exposure are deteriorated leaded paint and the soil and dust it contaminates in old housing. The construction of new housing and the demolition and rehabilitation of older housing may be contributing to a
continued decline in BLLs. Data from NHANES III, Phase 2 showed that low-income children living in older housing had more than a 30-fold greater prevalence of BLLs >10 µg/dL than do middle- income children in
newer housing (4). From 1993 to 1997, the number of low-income children
living in pre-1940s and 1940--1974 housing declined by 31% and 14%, respectively. The number of low-income children living in post-1974 housing increased by 5% (6).

Despite the overall decline in average BLLs, CBLS data show that the risk for elevated BLLs in children tested remains high in some counties
and varies greatly among and within states. This variation most likely reflects geographic variation in the prevalence of risk factors for

elevated BLLs such as residence in older housing and poverty.

The findings in this report are subject to at least four limitations. First, the small NHANES 1999 sample does not permit observing risks in specific subgroups or geographic areas, but it provides a nationally representative estimate of BLLs in children. The CBLS data set provides local information but is limited to children who receive clinical or diagnostic blood lead testing. Second, because CDC guidelines recommend the use of blood lead data and census data to target screening efforts in populations at increased risk for lead exposure, the proportion of children with elevated BLLs is higher in CBLS data than would be expected in NHANES 1999. Third, the guidelines for testing children vary by state, and adherence to the guidelines varies by health-care provider. Finally, CBLS data include samples collected by fingerstick, which can slightly over-estimate the blood lead result, and venous samples and results obtained by different laboratories. Despite these differences, the temporal trends in BLLs are similar between the CBLS and NHANES data sets.

One of the national health objectives for 2010 is the elimination of childhood lead poisoning (7). Data in this report document continued progress toward this goal but also show the ongoing need to target prevention efforts at communities and populations at highest risk. CDC recommends that state health agencies target screening efforts by using blood lead surveillance data, census data, Medicaid data, and other sources of information on risk factors such as housing age and poverty (8,9). Other federal agencies, including the U.S. Department of Housing and Urban Development and the U.S. Environmental Protection Agency, also are implementing targeted strategies to prevent lead exposure. State blood lead surveillance systems play a key role in targeting and monitoring federal, state, and local prevention efforts. CDC encourages additional states to conduct surveillance for elevated BLLs in children.

References

1.Agency for Toxic Substances and Disease Registry. Toxicological profile for lead. Atlanta, Georgia: US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, 1999.

2.Schwartz J. Low-level lead exposure and children's IQ: a meta-analysis and search for a threshold. Environ 1994;65:42--55.

3.Pirkle JL, Brody DJ, Gunter EW, et al. The decline in BLLs in the United States: the National Health and Nutrition Examination Surveys. JAMA 1994;272:284--91.

4.Pirkle JL, Kaufmann RB, Brody DJ, Hickman T, Gunter EW, Paschal DC.

Exposure of the US population to lead, 1991--1994. Environ Health Perspect 1998;106:745--50.

5.US Environmental Protection Agency. National air quality and emissions
trends report, 1998. Research Triangle Park, North Carolina: US Environmental Protection Agency, 2000.

6.President's Task Force on Environmental and Health Risks and Safety Risks to Children. Eliminating childhood lead poisoning: a federal strategy targeting lead paint hazards. Available at http://www.epa.gov/children/whatwe/leadhaz.pdf. Accessed December 2000.

7.US Department of Health and Human Services. Healthy people 2010: understanding and improving health. 2nd ed. Washington, DC: US Department of Health and Human Services, 2000.

8.CDC. Screening young children for lead poisoning: guidance for state and local public health officials. Atlanta, Georgia: CDC, 1997.

9.CDC. Recommendations for blood lead screening of young children enrolled in Medicaid: targeting a group at high risk. MMWR(in press).

TABLE 1. Percentage of children tested aged <6 years with elevated blood
lead levels (BLLs), by year - selected states*, 1996-1998

		% Children with elevated BLLs (μg/dL)		
Year	No. tested	>=10	>=15	>=20
1996	1,220,596	10.5%	3.9%	1.9%
1997	1,183,506	8.6%	3.2%	1.5%
1998	1,256,907	7.6%	2.7%	1.2%

* Alabama, Colorado, Connecticut, Iowa, Maine, Massachusetts, Michigan,
Minnesota, Montana, New Hampshire, New York, North Carolina, Ohio, Oklahoma, Utah, Vermont, Wash-ington, Wisconsin, and Wyoming.

FIGURE 1. State-specific percentage of children aged <6 years tested with blood lead levels (BLLs) >=10 μg/dL and highest and lowest percentage of elevated BLLs, by county - selected states, 1998*

http://www.cdc.gov/mmwr/preview/mmwrhtml/figures/m950a3f1.gif

* Only counties with >=200 children tested for BLL are included. Colorado, Washington, and Wyoming had <2 counties with 200 children tested, and Massachusetts did not report county of residence.